Summaries

UDC 621.039

Ushakov V.Ya.
THERMONUCLEAR POWER ENGINEERING: REALITY AND HOPES

The basic approaches to realization of thermonuclear synthesis in an operated mode, dynamics of parameter increase of developed thermonuclear reactors, and also a role of the international cooperation in solution of this problem are shown. The basic characteristics of the international project ITER are given.

UDC 541.16:182

Ilyin A.P., Korshunov A.V., Tolbanova L.O.
APPLICATION OF ALUMINUM NANOPOWDER IN HYDROGEN POWER ENGINEERING

The results of researches on interaction of aluminum nanopowder with water are presented. It is shown, that in conditions relative to low temperatures aluminum nanopowder totally cooperates with water, allocating «hot» hydrogen. The process of interaction is accompanied by the chemical-mechanical effect, decrease of water boiling temperature and self-heating of reacting particles. Formed nanoporous materials have various chemical and phase structure. Advantages and disadvantages of aluminum nanopowder application for hydrogen making are analyzed.

UDC 621.039.51

Alekseev A.V., Kuzmin A.V.
TO AGE COMPUTATION OF FISSION NEUTRONS IN METAL–WATER MIXTURES

Experimental and computation data by age definition of fission neutrons up to the indium resonance in mixtures Zr-H_2O, Al-H_2O, Fe-H_2O often used in reactor physics are analyzed. The approximations obtained on the basis of the least square method are shown, their error is estimated. The necessity of experimental age definition of neutrons in pure metals and search of alternative methods of computation are shown.

UDC 536.21

Gorodov R.V., Kuzmin A.V.
ON CHOICE OF THE TEMPERATURE PROFILE AT SOLVING OF THE EQUATION OF HEAT CONDUCTIVITY IN SPHERICAL COORDINATES BY THE METHOD OF THERMAL BALANCE INTEGRAL

Solutions for the equation of heat conductivity for a sphere and an area limited from within by a spherical cavity are obtained by means of the integrated method. The influence of choice of the temperature profile on efficiency of the approached analytical solution is shown. The variant of solution specification in transitive area is offered.

UDC 536.46

Knyazeva A.G., Chumakov Yu.A.
TWO–TEMPERATURE MODEL OF GAS BURNING IN A MODEL BURN DEVICE OF THE CYLINDRICAL FORM

The two-temperature model of gas burning in a porous body of cylindrical heat-generator is offered and numerically analyzed. Heat exchange between solid frame and gas; interaction of burning products with heat-exchanger; distinction of diffusion speeds and heat conductivity in the gas phase are considered in the model. The influence of model parameters on characteristics of stationary modes of gas burning for various heat exchange conditions of porous torch with heat exchanger- is investigated. The results of numerical research do not contradict with observable laws, which speaks about an opportunity of model use for statement and solving of the problem of work optimization of the real burning device.

UDC 636.468+536.3

Subbotin A.N.
IGNITION OF POROUS HIGH–ENERGY SUBSTANCES BY LIGHT RADIATION

The possibility of calculation of high-energy solid fuel ignition processes within the limits of the porous reacting body model is shown. Using the given model of ignition, it is possible to consider the dependence of ignition time on pressure which is established experimentally while within the limits of the classic solid-phase ignition theory the ignition time does not depend on the initial and the external pressure.

UDC 536.46

Sabdenov K.O., Dolmatov O.Yu., Yushitsyn K.V.
TO THE THEORY OF EROSIVE BURNING OF SOLID ROCKET FUELS

The explanation of the erosive burning threshold presence is offered. It is shown that such kind of burning begins at decrease in thickness of the laminar sublayer (in a turbulent boundary layer) below width of the laminar burning zone. The expressions connecting critical (threshold) speed of the blowing stream and critical number of V.N. Vilyunov with properties of fuel and gas formed at its decomposition are obtained. Simple sedate dependences on speed of the blowing stream are found for speed of burning.

UDC 536.46

Sabdenov K.O., Dolmatov O.Yu., Yushitsyn K.V.
TO INQUIRY OF NATURE OF THE CONCENTRATION BURNING LIMIT

The elemental theory of existence of concentration limits of slow burning and detonation is offered on the basis of development of Lewis' and Elba's ideas, theoretical works of A.M. Klimov on convective flame extinguishing and works of Ya.B. Zeldovich on flame disappearance at decrease in burning temperature below the critical value.

UDC 504.3.054:629

Dolotov A.E., Kuznetsov G.V., Nemova T.N.
NUMERICAL MODELING OF THE EVAPORATION PROCESS OF ASYMMETRICAL DIMETHYLHYDRAZINE DROPS IN THE EARTH'S ATMOSPHERE

The evaporation process of asymmetrical dimethylhydrazine drops at their movement to the Earth's surface after seal failure of fuel tanks of rockets-carriers at heights up to 50 km is simulated.

UDC 621.181.001.4:621.18

Zavorin A.S., Lyubimova L.L., Makeev A.A., Tashlykov A.A., Artamontsev A.I., Lebedev B.V.
INFLUENCE OF STRUCTURAL HETEROGENEITY OF METAL ON CORROSION OF STEAM BOILER PIPES

Estimation of metal structural heterogeneity degree and its influence on intergranular and intragranular creepage and connected with them processes of general and crater-pitting pipe corrosion of steam boilers is carried out on the basis of the roentgenophase analysis of samples taken from pipe steel 20.

UDC 621.165

Zalomikhin V.A., Kalugin B.F.
ANALYSIS OF WORK ON HEAT–COGENERATION TURBINE UNITS IN SCHEMES OF PRELIMINARY PREPARATION OF MAKEUP WATER

The new scheme of preliminary preparation of makeup water of various technological purposes at parallel work of turbine units with heat release to external consumers is offered. Variants of work of one of the existing and offered schemes are compared and analyzed. Use of the deve-

loped scheme in comparison with the existing allows cutting fuel expenses up to 15...16 % or 31 thousand tons of conditional fuel per heating period.

UDC 536.2:621.1.016

Goldaev S.V., Kovalev M.V.
ANALYSIS OF THERMOTECHNICAL CHARACTERISTICS OF RIBBED ECONOMIZERS OF STEAM BOILERS

It is established that the maximal values of total and unit mass heat-generation with the allocated developed surface of steam boiler economizer are not provided, unlike heat interchange by free convection of ribbed pipes, in a range of used in fact quantity of ribs, their thickness and blow speeds by smoke gases.

UDC 621.43.068

Maschenko V.Yu.
THE PROGRAM CYBERDIESEL FOR MATHEMATICAL MODELING OF FUEL SUPPLY AND LOCAL INTRACYLINDER PROCESSES IN A DIESEL ENGINE WITH VOLUMETRIC CARBURETION

The program CyberDiesel is developed on the basis of complex mathematical model of fuel supply and local intracylinder processes in a diesel engine with volumetric carburetion. The program is intended to solve practical problems of coordination of constructive and adjusting parameters of fuel equipment and combustion chamber of a diesel engine by methods of mathematical modeling.

UDC 620.18:669.14

Danilov V.I., Valuev D.V., Ivanov Yu.F., Apasov A.M.
PRECESION STRUCTURE OF STEEL St52,3N AND POSSIBLE REASONS OF DEFECT OF LARGE-CAPACITY BILLETS AT «YURMASH»

Electron-microscopic and X-ray investigation of structurally-phase and intense-deformed condition of material made from defective and conditional forged billet at «Yurmash» have been carried out. It is established that in steel made from the defective forged piece the fraction of perlite is 1,5...2 times bigger and lamellar perlite prevails. Local long-range tensions in both conditions of material are commensurable with fluidity limit. The content of sulfides is considerably higher in the steel made from the defective billet. These sulfides are located in the body of ferritic grains and along the interphase bonders. In the material made from the conditional forging they are located only inside of grains. The scalar density of dispositions in ferritic grains and in ferritic layers of perlite of the defected billet is one and a half time higher than in conditional metal. All the totality of the listed above circumstances allows to assert that the main cause of cracking of large-capacity billets made from steel St52,3N is not a full conformity of the chemical compound to branded requirements.

UDC 621.313.12

Nosov G.V.
COMPUTATION OF CURRENT IMPULSE SOURCES WITH INDUCTIVE ENERGY ACCUMULATORS

Formulas for computation of efficiency and parameters of current impulse sources at charging and discharging of the inductive energy accumulator on active loading are obtained. For charging the inductive accumulator the electric and capacitor batteries, unipolar and synchronous with the rectifier electromachine generators, equivalent circuit of which can be presented by consecutive connection of equivalent capacity, inductance and resistance are considered. Formulas, at which high efficiency of charge is reached, are obtained for computation of parameters of the inductive accumulator in the form of the multilayered coil. It is shown that current impulse sources are most effective at oscillatory charging of the inductive accumulator when more than 50 % of the generator energy can be transferred to loading.

UDC 621.311.001

Gusev A.S., Svechkarev S.V., Plodistiy I.L.
UNIVERSAL MATHEMATICAL MODEL OF POWER THREE-PHASE TRANSFORMERS AND AUTOTRANSFORMERS

The substantiation of necessity in essential increase of completeness and reliability of modeling processes in energy systems is shown. The results of synthesis of universal mathematical model of one of main elements of energy systems – power transformers and autotransformers are presented. The demanded quality of reproduction of processes is confirmed by experience of use of the developed model in structure of all-mode multiprocessing modeling complexes of real time of the hybrid type. The examples illustrating quality of process modeling are shown.

UDC 621.311

Goldstein E.I., Dzhumik D.V.
USE OF THE SAMPLED ELECTRICAL ENGINEERING DEVICE AT DIAGNOSING ELEMENTS IN ELECTROPOWER SYSTEMS

Stages of diagnosing procedures of the electropower system elements are presented. The specialized mathematical device – sampled electrical engineering is developed for work with massifs of instant values of currents and voltages obtained by digital registrars of electric signals. Key rules and procedures of the sampled electrical engineering device are presented.

UDC 621.311

Dzhumik D.V.
DEFINITION OF PARAMETERS OF EQUIVALENT CIRCUITS OF POWER TRANSMISSIONS, REACTORS, POWER RESISTORS AND CONDENSER BATTERIES BASED ON MASSIFS OF INSTANT VALUES OF CURRENTS AND VOLTAGES

The possibility of parameter definition of static elements of electropower systems based on massifs of instant values of currents and voltages for various problems of electropower engineering is shown. Procedures of parameter definition of the inverted G-shaped equivalent circuit of a line are considered. Procedures of parameter definition of an equivalent circuit of linear current-limiting reactor/resistor and computation results are shown.

UDC 621.391.822:621.375.1

Maslennikov V.N.
NOISE PROPERTIES OF THE VIDEOAMPLIFIER EXECUTED BASED THE CASCODE SCHEME WITH DYNAMIC LOADING

Relative influence of active elements implied on noises of the cascode scheme of the videoamplifier at resistive loading and at use of an active element as dynamic loading of the cascode is considered. The conclusion is drawn that in both cases the second transistor of the cascode scheme contributes an insignificant share in noises of the amplifier in comparison with the first. The contribution of noises of the active element of dynamic loading considerably exceeds the contribution of traditional resistive loading of the cascade and practically doubles in capacity the noise caused by the first active element.

UDC 621.372.57

Dovgun V.P., Novikov V.V.
ACTIVE FREQUENCY-DIVIDING FILTERS

The method of synthesis of analog frequency-dividing devices on the basis of wave filters is offered. Various variants of configurations of such filters are considered. It is shown that frequency-dividing filters synthesized according to the offered method, have the minimal order.

UDC 621.372.852

Stukach O.V.
MODELING OF ATTENUATOR STRUCTURES ON FIELD EFFECT TRANSISTORS WITH MINIMAL PHASE SHIFT AT ATTENUATION REGULATION

The base structures of the controlled absorbing attenuators on FETs are considered and their phase frequency characteristics were modeling. The main difference of the circuits from known consists in broadband feature and large attenuation range where minimum of the phase shift is achieved at regulation. As a result, the optimal parameters of adjusting circuits in attenuators are founded. It is shown that the least phase shift is provided in attenuators on transistor with controlled volt-ampere characteristic steepness. The comparative estimation of the considered base structures was given.

UDC 621.3

Titov V.G., Abramov S.V.
SIMULATOR OF CHARACTERISTICS OF FUEL ELEMENTS ON THE BASIS OF THE SEMICONDUCTOR CONVERTER

The results of development and research of the simulator of characteristics of fuel elements based on the operated impulse converter with di-

rect current and digital alarm processor are considered. The electrochemical model of fuel element considering its static and dynamic characteristics is incorporated in the algorithm of work of the processor. The specified simulator has on clips of loading the same characteristics of output capacity as a real system. At phases of research, designing and realization of independent systems of power supplies on the basis of fuel elements it allows to dismiss the use of elements and expensive accompanying systems.

UDC 621.396.6

Karaban V.M.
MATHEMATICAL MODEL FOR CONSIDERATION OF CHANGE IN HEATER CAPACITY FOR PROPORTIONAL TEMPERATURE REGULATOR OF THE HYBRID-FILM MICROTHERMOSTAT

The numerical modeling of two-dimensional non-stationary temperature fields of thermostatically controlled substrate for proportional temperature regulator of the hybrid-film microthermostat in view of change in heater capacity caused by instability of feeding currents is executed. The method of final differences is used together with the scheme of splitting along the coordinates and the trial run method. The mathematical model of definition in change of heater capacity for the proportional temperature regulator of hybrid-integrated schemes is offered, allowing providing stability of work of the automatic temperature control system.

UDC 621.31-5

Krasnov I.Yu.
RESEARCH OF THE AUTOMATED PRECISION BATCHING OF LOOSE MATERIALS SYSTEM

The imitating model of the automated batching of loose materials system, including the robust system of engine control of worm feeders is considered. The model is described in space of conditions by means of the programming language MATLAB, the interface of S-functions and the Simulink environment. The Kalman's filter is used for noise filtration in the channel of measurement. Graphic representation of modeling results proves adequacy of the imitating batching model, efficiency of the method of regulator parameter retuning and expediency of use of the algorithm of measured signal filtration. The error on weight at presence of parametrical indignations on the worm feeder engine without retuning regulator parameters makes 0,3 kg (+3 %) at the set 10 kg, and with retuning regulator parameters makes 0,01 kg (+0,1 %).

UDC 628.12

Tolparov D.V., Dementiev Yu.N.
ANALYSIS OF PUMP STATION CONTROL SYSTEMS

Systematization and comparative analysis of circuit solutions of pump station control systems is carried out. The main features during work of various control systems of the automated stations are presented. Criteria for a choice of effective configurations of control systems are formulated.

UDC 621.313.36

Kachin O.S.
DIAGNOSING MECHANICAL CONDITION OF THE COLLECTOR-BRUSH UNIT OF THE HIGH-SPEED ELECTRIC MACHINE DURING RESOURCE TESTS

Questions on definition of mechanical condition of collector-brush units in dynamic modes with application of the developed in TPU techniques of result processing obtained with use of contactless profile meter are considered. The results of experimental researches of mechanical condition of the collector-brush unit of the electric motor with alternating current during the process of resource operating time are presented. The analysis of experimental data is carried out. Recommendations on improvement of current collection conditions in the sliding contact and increasing of the brush resource are developed.

UDC 621.313

Avilov V.D., Popov D.I.
SLIDING CURRENT COLLECTOR IN MOTORS OF THE DIRECT CURRENT

The new method of sliding current collector has been developed. Its theoretical research has been carried out. The operating model sample of the current collector device using the rolling contact has been made.

UDC 621.314.6

Avilov V.D., Tretyakov E.A., Moskalev Yu.V.
APPLICATION OF RANDOM SEARCH ALGORITHMS AT OPTIMIZATION OF ELECTRIC ENERGY QUALITY IN NETWORKS OF STATIONARY RAILWAY ENTERPRISES

The possibility of system construction of optimum quality of electric energy control based on the established deviation and asymmetry of voltage at stationary railway enterprises with application of the decentralized accommodation of correcting device principle is shown.

UDC 621.311.016.361

Gotman V.I., Markman G.Z.
GENERALIZED STATIC CHARACTERISTICS OF ELECTRO-POWER SUBSYSTEMS AND THEIR STEEPNESS COEFFICIENTS

Representation of parts of electropower systems by generalized static characteristics is considered. The design procedure of steepness coefficients of generalized static characteristics depending on features of equivalent subsystems is discussed. Generalized static characteristics and their steepness coefficients give the equivalent information on power subsystems and can be used at estimation of static aperiodic stability of power supply systems.

UDC 621.311.016

Gotman V.I.
COMMON ALGORITHM OF STATIC STABILITY ESTIMATION AND COMPUTATION OF THE ESTABLISHED MODES OF POWER SUPPLY SYSTEMS

Generators with automatic control of excitation at research of static stability of modes of electric systems are considered by transfer functions. Conditions of free number concurrence of the characteristic equation and the Jakob's matrix used in calculations of established modes by the Newton's method for various idolized models of the generator are analyzed. Features of use of practical criteria of stability are considered.

UDC 621.311.019

Krivova L.V., Shmoylov A.V.
SELECTION AND INSPECTION OF POWER PLANT ELEMENTS WITH APPLICATION OF PROBABILITY METHODS

Probabilistic criteria of overload and destruction risks at substantiation of the chosen power components of electric installations under operating conditions and emergency influences are developed. The example of inspection of rigid modular trunks of the Surgut State District Power Station-1 is shown.

UDC 621.186

Belyaev L.A., Zavorin A.S., Kosyakov S.A., Krivoguzov K.A.
COMPLEX ANALYSIS OF REPAIR PLANNING OF POWER STATION EQUIPMENT IN GENERATING COMPANIES

The problem of repair planning of thermal power stations equipment in conditions of transition to adjustable markets of energy is analyzed. The bases of application of the system approach in conditions of real restrictions by financial resources are stated. The method based on classification of sources of repair work initiation and considering priorities of works for different levels of management is offered as the algorithm of planning.

UDC 621.04.18

Efremov V.V., Markman G.Z.
«ENERGY SUPPLY» AND «ENERGY EFFECTIVENESS»: SPECIFICATION OF CONCEPTS, THE SYSTEM OF BALANCED PARAMETERS OF ENERGY EFFECTIVENESS

On the basis of the analysis of concepts «Energy supply» and «Energy effectiveness» the inadmissibility of their identification is shown. Parameters for quantitative characteristic of these concepts are specified. For the first time it is offered to use the system of balanced parameters of energy effectiveness for development of norms of electric energy consumption.